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# Antioxidant properties of various parts *Cissus quadrangularis* L. in different solvents

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## ABSTRACT

An important medicinal plant *Cissus quadrangularis*, belonging to the family Vitaceae was used in the present study to estimate antioxidant properties of different extract (root, stem, leaves and tendrils). Plant materials were collected from the village Ponnanthittu, Chidambaram Taluk, Cuddalore Dist, The antioxidant properties of the petroleum ether, chloroform, ethyl acetate, acetone and methanol extracts of *Cissus quadrangularis* were screened and results showed considerable antioxidants in all the extracts.

**KEYWORDS:** *Cissus quadrangularis* L., various parts, different solvents, antioxidants

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## INTRODUCTION

Medicinal plants are the backbone of the traditional medicines [1]. The past 2500 years, there have been very strong traditional systems of medicines born and practiced more in the eastern continent. Approximately 80% of population in the developing countries still rely on these systems of medicines for their primary health care needs [2]. Moreover, herbal medicines are considered to be less toxic and free from side effects than synthetic ones. The chemical compounds found in plants are natural products that have pharmacological and biological activity and hence, they are generally used in drug discovery and drug design [3]. Medicinal plants are rich source of compounds or secondary metabolites like tannins, terpenoids, alkaloids, flavonoids, etc. [4,5].

*Cissus quadrangularis* is an important medicinal plant with traditional and modern medicinal uses [6]. Previous studies are about antioxidant potentials from stem of plants and with antimicrobial actions from this plant [7] and antioxidants from stem portions [8]. In the present study, we aimed to estimate antioxidant properties of different extract (root, stem, leaves and tendrils) from medicinal plant *Cissus quadrangularis*.

## MATERIALS AND METHODS

### Antioxidant Activity

The radical scavenging effects of different parts (root, stem, leaves and tendrils) of crude extracts of *Cissus quadrangularis* were evaluated against 1,1-diphenyl-2-picrylhydrazyl, ABTS<sup>+</sup>,

hydrogen peroxide, superoxide radical, Nitric oxide radical, hydroxyl radicals scavenging assay, ferric reducing antioxidant power, total phenol, total flavonoids content and total antioxidant activity.

All the chemicals and solvents used in the study were analytical grade (AR). 1,1-diphenyl-2-picrylhydrazyl (DPPH), quercetin, gallic acid (TCA), ascorbic acid, monobasic and dibasic phosphate, potassium ferric cyanide, sulphuric acid, sodium phosphate, EDTA, ammonium molybdate, NBT-Nitroblue tetrazolium, BHT, ferric chloride, ammonium acetate, acetyl acetate, potassium phosphate buffer, potassium phosphate saline, phosphoric acid, ferrozine, methanol and were obtained from Himedia, India.

### DPPH Free Radical Scavenging Activity

The DPPH scavenging activity of different extracts of *C. quadrangularis* root, stem, leaves and tendrils were measured according to the procedure described by Hatano *et al.* [9].

### ABTS<sup>+</sup> Scavenging Effects (2, 2'-Azino-bis-3-ethylbenzthiazoline- 6-sulphonic acid)

ABTS<sup>+</sup> scavenging effects was measured according to the method of Re *et al.* [10].

### Superoxide Anion Radical Scavenging Activity Assay

The Superoxide anion radical scavenging was measured by the method of Liu *et al.* [11].

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### Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>) Scavenging Assay

Hydrogen peroxide scavenging activity of the extract was measured by standard method [12].

### Hydroxyl Radical Scavenging Assay

The scavenging activity for hydroxyl radicals was measured with fenton reaction by the standard method [13].

### Ferric Reducing Antioxidant Power (FRAP)

The FRAP assay was used to estimate the reducing capacity of plant extracts, according to the method of Benzie and Strain [14].

### Determination of Total Antioxidant Activity

The antioxidant activity of the extracts was evaluated by the phosphomolybdenum method according to the procedure of Prieto *et al.* [15].

## RESULT AND DISCUSSION

The antioxidant properties of the petroleum ether, chloroform, ethyl acetate, acetone and methanol extracts of *Cissus quadrangularis* were screened and results showed considerable antioxidants in all the extracts. The ethanolic extracts of the leaves of *Carica papaya*, *Psidium guajava* and *Vernonia amygdalina*, stem bark of *Mangifera indica* were screened for their free radical scavenging activity [16]. The antioxidant screening of ethanolic extracts of *Viola serpens* and *Morus nigra* showed the presence of enzymatic antioxidant such as catalase, peroxidase and ascorbate oxidase and non-enzymatic antioxidant such as ascorbic acid [17].

The antioxidant activity by DPPH method indicated that ethanolic extract of *Phragmites vallisneria* possessed considerable antioxidant activity. The highest radical scavenging activity was  $IC_{50}=73 \mu\text{G/mL}$ . Seven compounds were identified in GC-MS analysis [18].

### Superoxide Radical Scavenging Activity

The results of superoxide radical scavenging activity of petroleum ether, chloroform, ethyl acetate, chloroform and methanolic extracts root, stem, leaves and tendrils of *C. quadrangularis* and standard are shown in Figure 1. The inhibition of superoxide anion radical scavenging activity generation is lower than that of ascorbic acid (standard). The inhibition of SOD at the concentrations (20, 40, 60, 80 and 100  $\mu\text{g/mL}$ ) recorded.

The highest inhibition was produced by methanol extracts, and then followed by ethyl acetate, acetone, chloroform and petroleum ether extracts. The antioxidants values of methanol extracts of root, stem, leaf, tendril and standard (ascorbic acid) were  $38.70 \pm 0.04$ ,  $86.64 \pm 0.04$ ,  $59.53 \pm 0.04$ ,  $28.21 \pm 0.04$  and

$99.96 \pm 0.02 \mu\text{g/mL}$  respectively at 100  $\mu\text{g/mL}$  concentration of the extract. The  $IC_{50}$  values of methanol extracts were 303  $\mu\text{g/mL}$  (root), 267  $\mu\text{g/mL}$  (stem), 325  $\mu\text{g/mL}$  (leaves), 456  $\mu\text{g/mL}$  (tendrils) and 204  $\mu\text{g/mL}$  (ascorbic acid).

### Hydroxyl Radicals Scavenging Activity

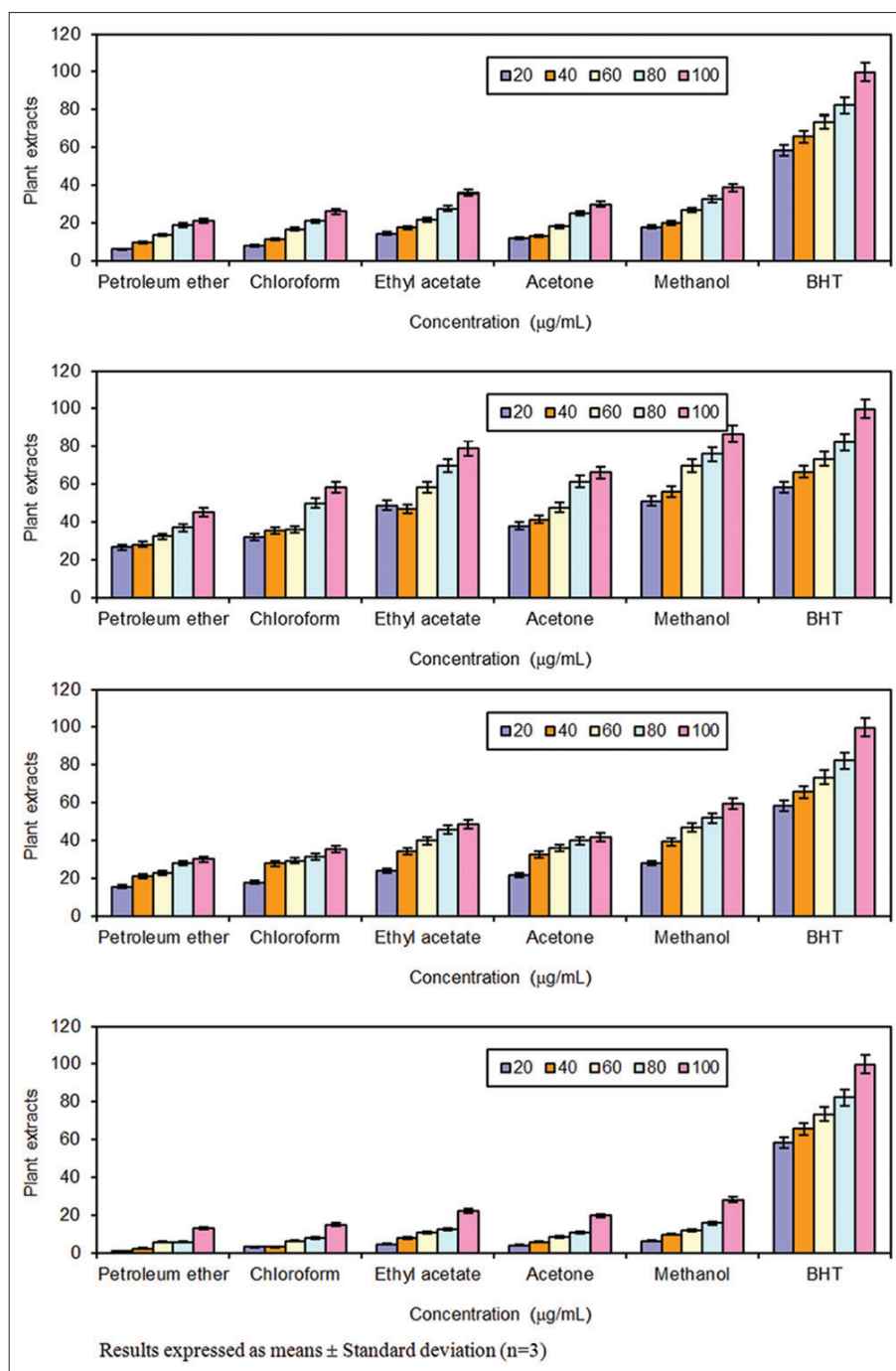
The results of hydroxyl radical scavenging activity of various extracts of *C. quadrangularis* and ascorbic acid are shown in Figure 2. A significant difference was observed among the parts of *C. quadrangularis* in difference concentrations of hydroxyl radicals scavenging activity. The highest antioxidant capacity was recorded in methanol extracts of *C. quadrangularis*, and then followed by ethyl acetate, acetone, chloroform and petroleum ether. Among the extracts, the highest activity was recorded in methanol extracts of stem ( $49.06 \pm 0.02 \mu\text{g/mL}$ ), followed by leaves ( $43.56 \pm 0.02 \mu\text{g/mL}$ ), root ( $31.12 \pm 0.30 \mu\text{g/mL}$ ) tendrils ( $19.87 \pm 0.02 \mu\text{g/mL}$ ) and ascorbic acid ( $63.55 \pm 0.03 \mu\text{g/mL}$ ) at 100  $\mu\text{g/mL}$  concentration. The methanol extracts exhibited  $IC_{50}$  values were 525  $\mu\text{g/mL}$  (root), 495  $\mu\text{g/mL}$  (stem), 516  $\mu\text{g/mL}$  (leaf), 621  $\mu\text{g/mL}$  (tendril) and 453  $\mu\text{g/mL}$  (ascorbic acid).

### Hydrogen Peroxide Scavenging Activity

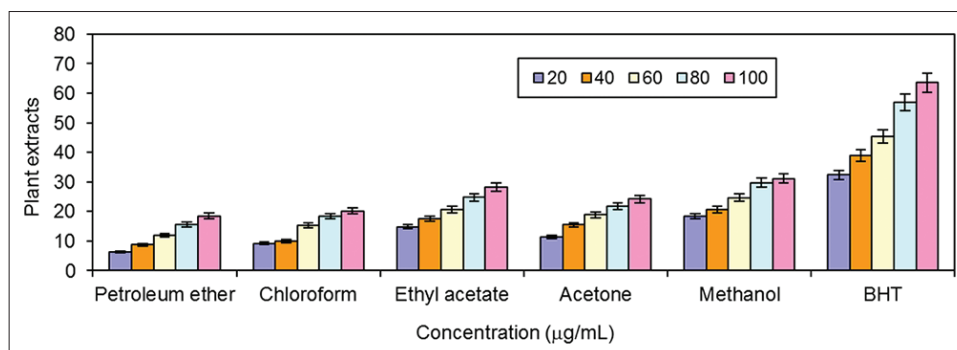
The results of hydrogen peroxide scavenging activity in various extracts of *C. quadrangularis* are shown in Figure 3. A significant activities was found among the samples of *C. quadrangularis* in different concentrations of 20, 40, 60, 80 and 100  $\mu\text{g/mL}$ . The highest H<sub>2</sub>O<sub>2</sub> scavenging potential was recorded with methanol extracts of all the samples, followed by ethyl acetate, acetone, chloroform and petroleum ether. Among the various parts of plant, the highest antioxidant potential was observed in stem, followed by leaves, root and tendrils. The hydrogen peroxide scavenging activity of methanolic extracts of root, stem, leaves, tendrils and control were  $20.23 \pm 0.01$ ,  $31.15 \pm 0.01$ ,  $24.61 \pm 0.01$ ,  $19.28 \pm 0.01$  and  $38.53 \pm 0.05 \mu\text{g/mL}$  respectively at 100  $\mu\text{g/mL}$  concentration. The  $IC_{50}$  values of methanolic extracts of root, stem, leaves, tendrils and control were 430, 289, 329 and 489  $\mu\text{g/mL}$  respectively when compared to the ascorbic acid (254  $\mu\text{g/mL}$ ).

### Ferric Reducing Antioxidant Powder Assay (FRAP)

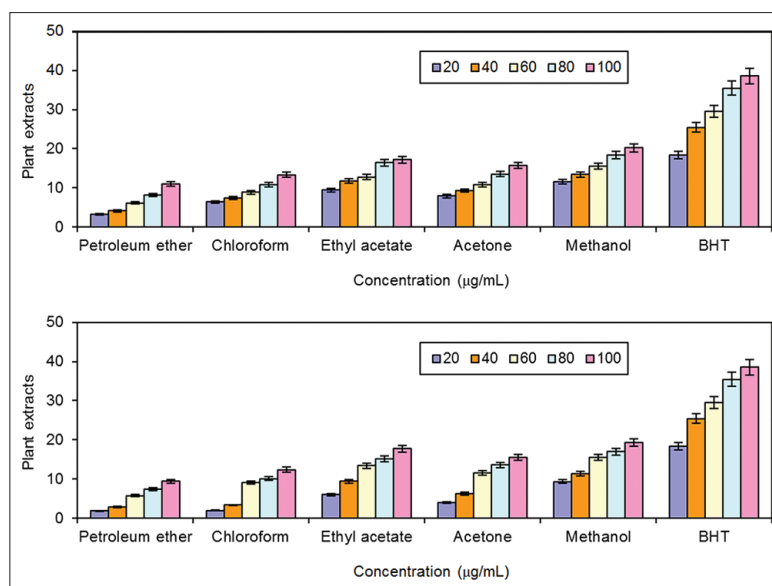
The FRAP assay results of different extracts of *C. quadrangularis* are presented in Figure 4. The inhibition of FRAP generation was lower than that of ascorbic acid. The inhibition of FRAP at the concentration of 20, 40, 60, 80 and 100  $\mu\text{g/mL}$  was recorded. On the other hand, at the same concentration of ascorbic acid, the highest antioxidant activity was observed in stem of *C. quadrangularis* and then followed by leaves, root and tendrils. Among the extracts, methanol extracts exhibited the potential FRAP values. The FRAP values of methanolic extracts of root, stem, leaves, tendril and ascorbic acid were  $12.45 \pm 0.04$ ,  $17.52 \pm 0.02$ ,  $14.23 \pm 0.02$ ,  $9.71 \pm 0.02$  and  $20.92 \pm 0.03 \mu\text{g/mL}$  respectively at 100  $\mu\text{g/mL}$  concentration. The  $IC_{50}$  values of the same extracts were 690, 589, 683 and 725  $\mu\text{g/mL}$  respectively compared with standard value (503  $\mu\text{g/mL}$ ).



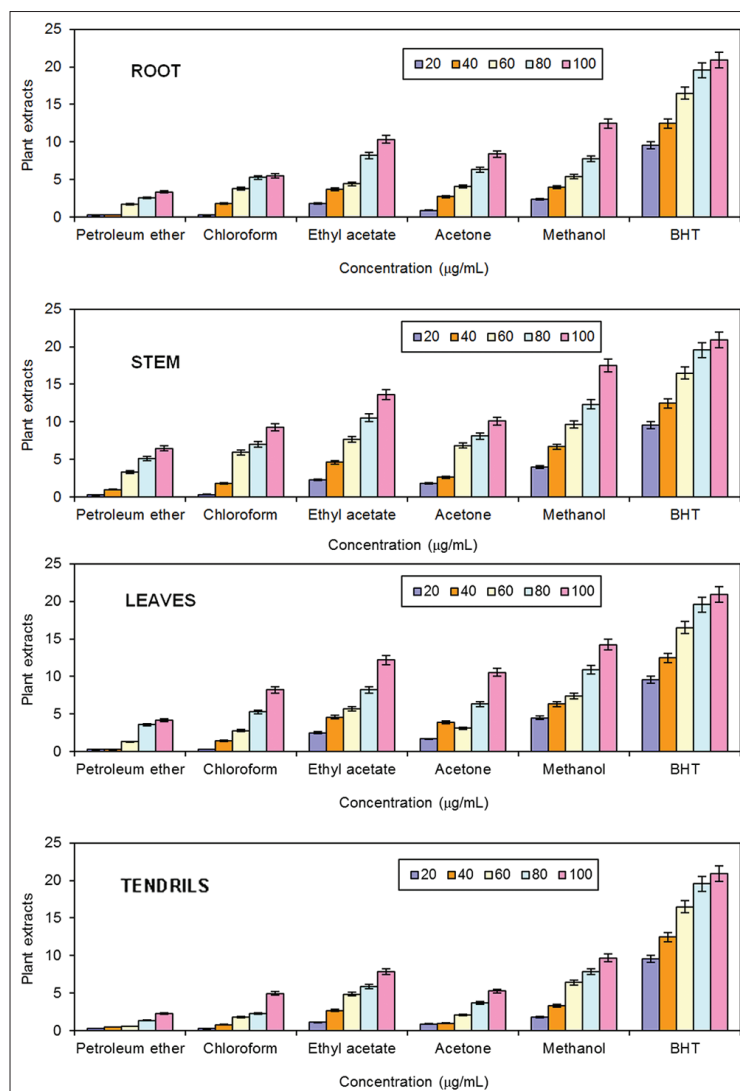
**Figure 1:** Superoxide radical scavenging activity of different extracts of root, stem, leaves and tendrils of *C. quadrangularis*



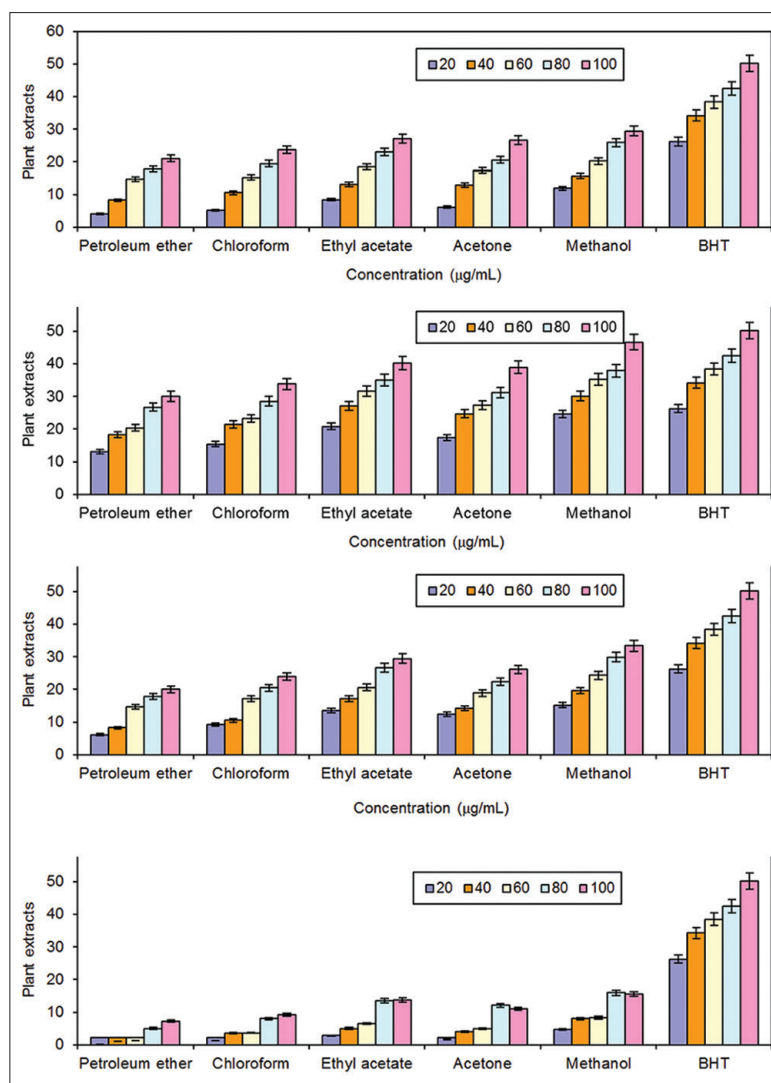
**Figure 2:** Hydroxyl radical scavenging activity of different extracts of root, stem, leaves and tendrils of *C. quadrangularis*



**Figure 3:**  $H_2O_2$  scavenging activity of different extracts of root, stem, leaves and tendrils of *C. quadrangularis*



**Figure 4:** Ferric reducing antioxidant power assay of different extracts of root, stem, leaves and tendrils of *C. quadrangularis*



**Figure 5:** ABTS<sup>+</sup> scavenging effects (2,2-azino-bis-3-ethylbenzothiazoline-6-sulphonic acid) of root, stem, leaves and tendrils extracts of *C. quadrangularis*

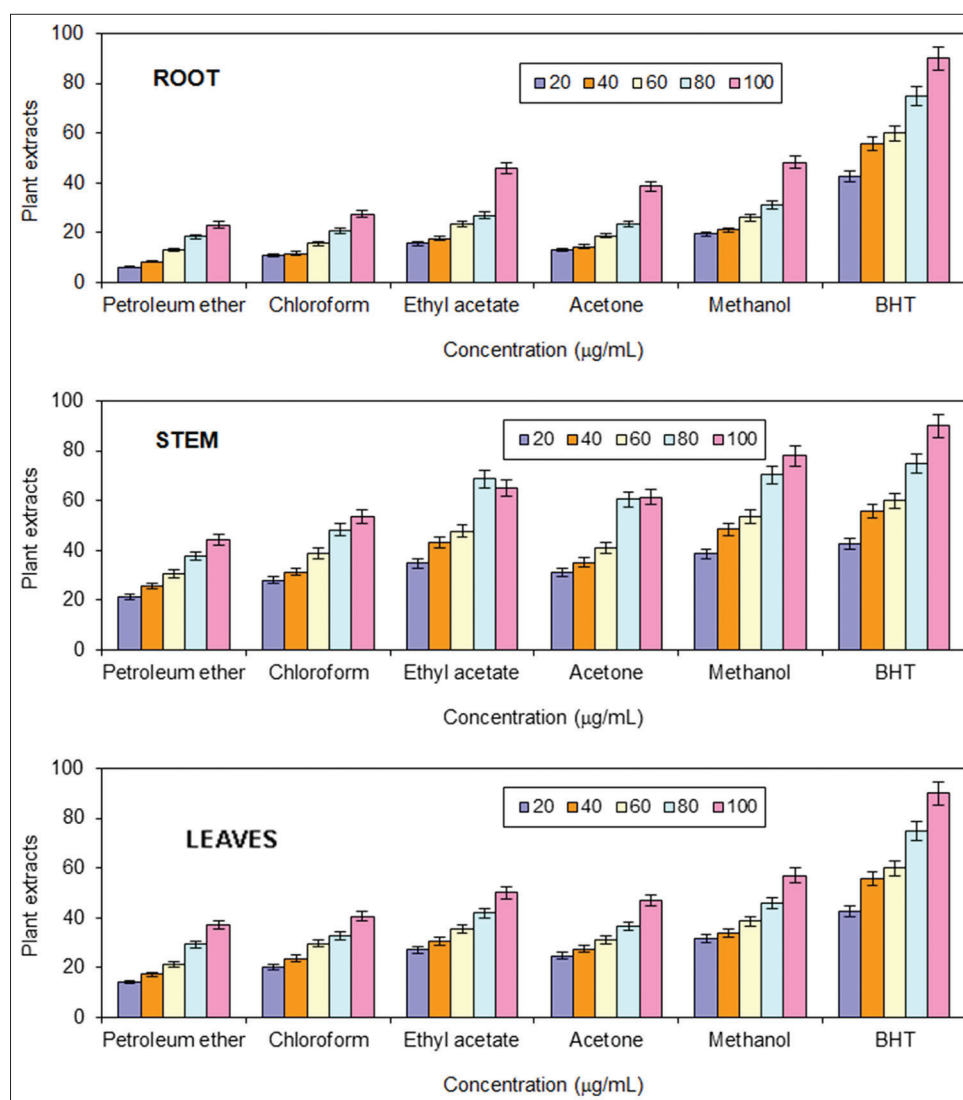
### ABTS<sup>+</sup> scavenging effects (2,2-azino-bis-3-ethylbenzothiazoline- 6-sulphonic acid)

The results of ABTS<sup>+</sup> radical scavenging activity of petroleum ether, chloroform, ethyl acetate acetone and methanol extract of root, stem, leaves and tendrils of *C. quadrangularis* are shown in Figure 5. A statistical significant difference ( $p < 0.05$ ) was found among the samples of *C. quadrangularis* in different concentrations (20, 40, 60, 80 and 100  $\mu\text{g/mL}$ ). Among the samples, stem extracts exhibited the highest antioxidant properties and then followed by leaves, root, and tendrils. The methanol extracts produced remarkable antioxidant potential when compared to other solvents. The methanol extracts of *C. quadrangularis* root, stem, leaves, tendrils and standard values were  $29.45 \pm 0.02$ ,  $46.63 \pm 0.23$ ,  $33.34 \pm 0.03$ ,  $15.56 \pm 0.04$  and  $50.19 \pm 0.03$  respectively at 100  $\text{mg/mL}$  concentration. The same extracts produced  $\text{IC}_{50}$  values were 392  $\mu\text{g/mL}$  (root), 333  $\mu\text{g/mL}$  (stem), 367  $\mu\text{g/mL}$

(leaf) and 412  $\mu\text{g/mL}$  (tendril) compared with standard value (288  $\mu\text{g/mL}$ ).

### Total Antioxidant Activity

The results of total antioxidant activity of different extracts of *C. quadrangularis* are shown in Figure 6. A significant result was recorded in various concentrations of 20, 40, 60, 80 and 100  $\mu\text{g/mL}$ . The highest total antioxidant activity was observed in stem extracts and then followed by leaves, root and tendrils. Among the solvents, the methanol extracts produced potential total antioxidant properties when compared to other solvents. The total antioxidant values of methanol extracts of *C. quadrangularis* were  $48.12 \pm 0.02$   $\mu\text{g/mL}$  (root),  $77.87 \pm 0.03$   $\mu\text{g/mL}$  (stem),  $57.06 \pm 0.02$   $\mu\text{g/mL}$  (leaves),  $26.56 \pm 0.03$   $\mu\text{g/mL}$  (tendrils) and 89.96  $\pm 0.02$   $\mu\text{g/mL}$  (standard value) at 100  $\text{mg/mL}$  concentration. The methanol extracts exhibited  $\text{IC}_{50}$  values were 286  $\mu\text{g/mL}$  (root), 212  $\mu\text{g/mL}$  (stem), 245  $\mu\text{g/mL}$



**Figure 6:** Total antioxidant activity different extracts of *C. quadrangularis* root, stem, leaves and tendrils

(leaves) and 314 µg/mL (tendrils) compared with standard value (198 µg/mL).

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